



MAP9001, MAP9002, MAP9003

High Voltage AC LED Driver

High Voltage AC LED Driver

General Description

The MAP900X family is a LED Driver which has high input voltage ranged from 90V to 270V. It can drive several series LEDs from rectified AC voltage.

The MAP900X family can achieve 0.95 or higher power factor and low total harmonic distortion less than 20%.

The MAP900X family has higher LED current drive capability up to 240mA and the current can be adjustable with external resistors.

The MAP900X family is available in eSOP-16, eSOP-8, SOP-8 with Halogen-free (fully RoHS compliant).

For more information, please contact local MagnaChip sales office in world-wide or visit MagnaChip's website.

Features

- Flicker-free (MAP9001)
- EMI improvement
- Input power variation: $\pm 10\%$
- Higher power factor : > 0.95
- Lower total harmonic distortion : $< 20\%$
- Higher current drive capability
Up to 240mA
- eSOP-16, eSOP-8, SOP-8

Applications

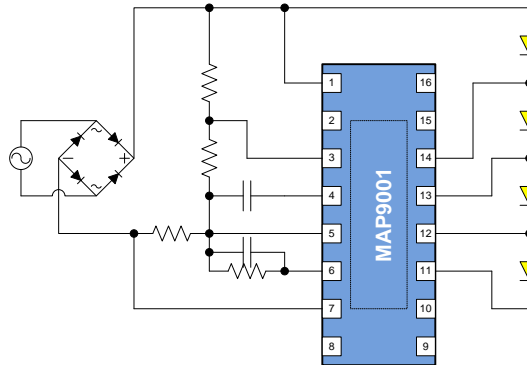
- AC LED Driver
- Lighting equipment
- LED Driver Power Supplies

Ordering Information

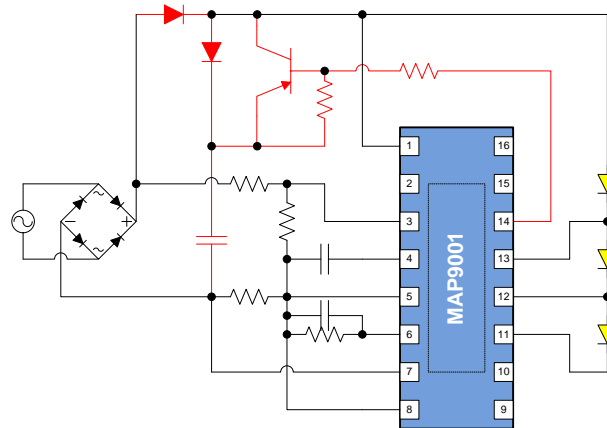
| Part Number | Top Marking | Ambient Temperature Range | Package | RoHS Status |
|-------------|-------------|---------------------------|---------|--------------|
| MAP9001ESRH | MAP9001 | -30°C to +85°C | eSOP-16 | Halogen Free |
| MAP9002ESRH | MAP9002 | -30°C to +85°C | eSOP-8 | Halogen Free |
| MAP9003SIRH | MAP9003 | -30°C to +85°C | SOP-8 | Halogen Free |

Simplified Application Circuit

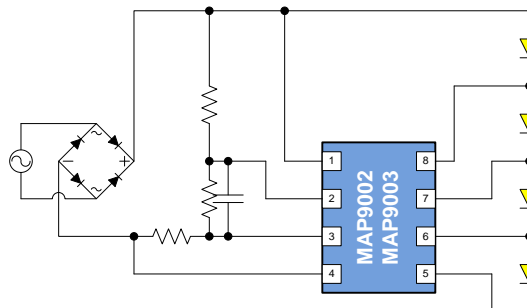
- MAP9001



- MAP9001 with flicker-free (Compliance with Energy Star)

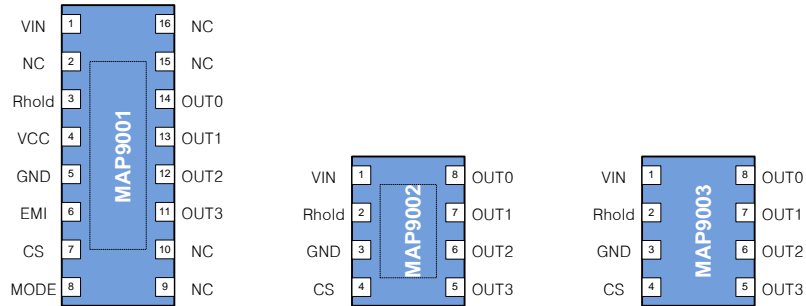


- MAP9002 & MAP9003



Pin Configuration & Description

- Pin Configuration



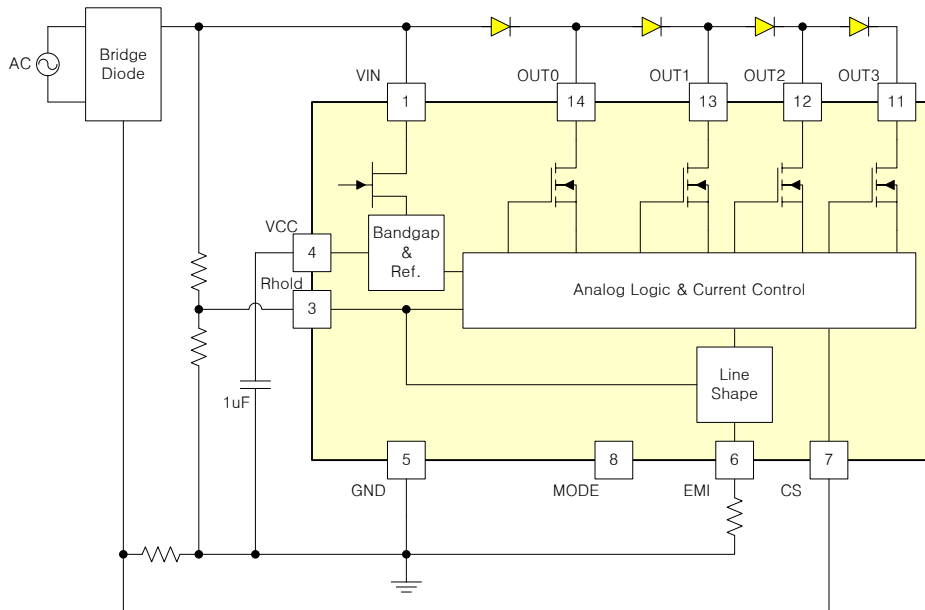
- Pin Description

| Pin | | MAP9001 |
|-----|-------|----------------------|
| 1 | VIN | VCC charging |
| 2 | NC | No Connection |
| 3 | Rhold | HOLD turn-on voltage |
| 4 | VCC | VCC |
| 5 | GND | Ground |
| 6 | EMI | EMI improvement |
| 7 | CS | Current sensing |
| 8 | MODE | Flicker-free mode |
| 9 | NC | No Connection |
| 10 | NC | No Connection |
| 11 | OUT3 | Output – 3 |
| 12 | OUT2 | Output – 2 |
| 13 | OUT1 | Output – 1 |
| 14 | OUT0 | Output – 0 |
| 15 | NC | No Connection |
| 16 | NC | No Connection |

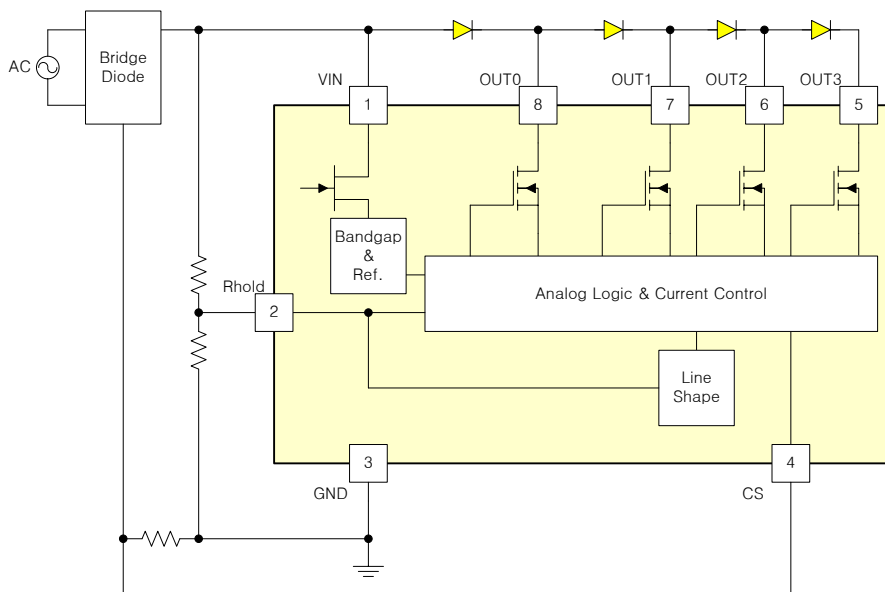
| Pin | | MAP9002, MAP9003 |
|-----|-------|----------------------|
| 1 | VIN | VCC charging |
| 2 | Rhold | HOLD turn-on voltage |
| 3 | GND | Ground |
| 4 | CS | Current sensing |
| 5 | OUT3 | Output – 3 |
| 6 | OUT2 | Output – 2 |
| 7 | OUT1 | Output – 1 |
| 8 | OUT0 | Output – 0 |

Functional Block Diagram

- MAP9001



- MAP9002 & MAP9003



Absolute Maximum Ratings

| PARAMETER | | VALUE | UNIT | |
|-------------------------------------|------------------------|------------|------|----|
| VIN | | 700 | V | |
| HOLD, OUT1, OUT2, OUT3 | | -0.3 ~ 700 | V | |
| EMI,CS | | -0.3 ~ 6 | V | |
| VCC, Rhold, MODE | | 20 | V | |
| Operating Temperature Range | | -40 ~ 125 | °C | |
| Junction Temperature Range | | -40 ~ 150 | °C | |
| Storage Temperature Range | | -65 ~ 150 | °C | |
| Lead temperature(soldering, 10sec) | | 260 | °C | |
| ESD Susceptibility | HBM (Note 1) | 2000 | V | |
| | MM (Note 2) | 200 | V | |
| | CDM (Note 3) | 1000 | V | |
| Internal MOSFET Section | IDMAX(DC) (Note 4) | IOUT0 | 123 | mA |
| | | IOUT1 | 172 | mA |
| | | IOUT2 | 172 | mA |
| | | IOUT3 | 172 | mA |
| | IDMMAX(Pulse) (Note 5) | IOUT0 | 491 | mA |
| | | IOUT1 | 688 | mA |
| | | IOUT2 | 688 | mA |
| | | IOUT3 | 688 | mA |

Note 1: ESD tested per JESD22A-114.

Note 2: ESD tested per JESD22A-115.

Note 3: ESD tested per JESD22C-101E

Note 4: Continuous Drain Current

Note 5: Pulsed Drain Current, Pulse width $\leq 10\mu\text{s}$, duty cycle $\leq 1\%$,

Thermal Resistance

| PARAMETER | | VALUE | UNIT |
|---|------------------|-------|------|
| Thermal Resistance (θ_{JA}), (Note4) | MAP9001(eSOP-16) | 52.6 | °C/W |
| Thermal Resistance (θ_{JT}), (Note5) | | 13.0 | °C/W |
| Thermal Resistance (θ_{JA}), (Note4) | MAP9002(eSOP-8) | 62.8 | °C/W |
| Thermal Resistance (θ_{JT}), (Note5) | | 22.2 | °C/W |
| Thermal Resistance (θ_{JA}), (Note4) | MAP9003(SOP-8) | 100.7 | °C/W |
| Thermal Resistance (θ_{JT}), (Note5) | | 50.5 | °C/W |

Note 4: Multi-layer PCB based on JEDEC standard (JESD51-7, 4Layer PCB)

Note 5: The metal PCB's diameter is

- ✓ MAP9001 50mm and height is 1.6t.
- ✓ MAP9002 53mm and height is 1.6t.
- ✓ MAP9003 47mm and height is 1.6t.

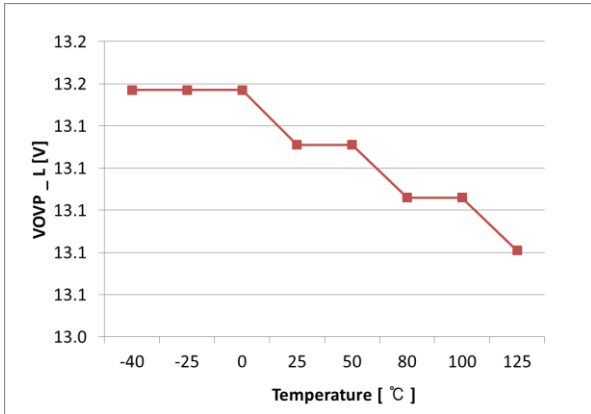
Electrical Characteristics

Ta = 25°C, CS Resistance = 6.8Ω unless otherwise specified

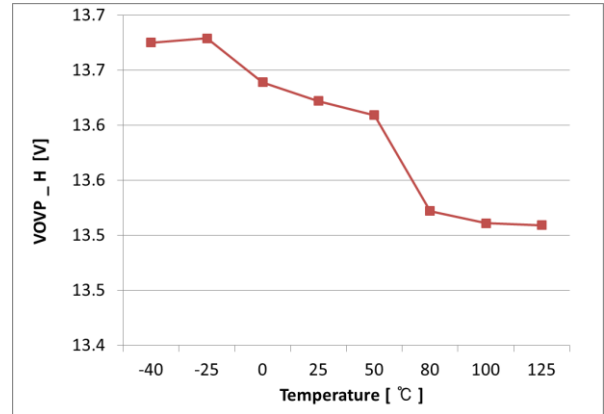
| SYMBOL | PARAMETER | TEST CONDITION | MIN | TYP | MAX | UNIT |
|--------------------------------|---------------------------------|--|-------|------|-------|------|
| Supply | | | | | | |
| V _{VIN} | Input voltage range | Note 6 | 50 | | 700 | V |
| V _{VCC} | Operating voltage | | - | 15 | - | V |
| I _{op} | Operating current | | 210 | 465 | 720 | μA |
| V _{VULO} | Under voltage lockout | UVLO_H | - | 12 | - | V |
| | | UVLO_L | - | 10 | - | V |
| Driver Section | | | | | | |
| V _{Rhold} | Rhold reference voltage | V _{VIN} = 200V, V _{GNND} = 0V V _{MODE} = open | 4.5 | 5.2 | 5.9 | V |
| OVP_H | Over voltage protection | V _{VIN} = 200V, V _{GNND} = 0V | 12.2 | 13.5 | 14.8 | V |
| OVP_L | Over voltage protection release | V _{VIN} = 200V, V _{GNND} = 0V | | 13.2 | | V |
| I _{D Leak} | Driver leakage current | V _{VIN} = 200V, V _{GNND} = 0V, V _{OUT0-3} = 400V | - | - | 10 | μA |
| I _{OUT0} | Driver 0 current | V _{VIN} = 200V, V _{OUT0} = 40V V _{Rhold} = 0V | - | 85 | - | mA |
| I _{OUT1} | Driver 1 current | V _{VIN} = 200V, V _{OUT1} = 40V V _{Rhold} = 0V | - | 130 | - | mA |
| I _{OUT2} | Driver 2 current | V _{VIN} = 200V, V _{OUT2} = 40V V _{Rhold} = 0V | - | 155 | - | mA |
| I _{OUT3} | Driver 3 current | V _{VIN} = 200V, V _{OUT3} = 40V V _{Rhold} = 0V | - | 185 | - | mA |
| I _{OUT_SUM} | | I _{OUT0} + I _{OUT1} + I _{OUT2} + I _{OUT3} | 527.5 | 555 | 587.5 | mA |
| Internal MOSFET Section | | | | | | |
| R _{DS(ON)1} | Drain to source resistance | V _d =30V, V _s =0V | | 255 | | mohm |
| R _{DS(ON)2} | Drain to source resistance | V _d =30V, V _s =0V | | 130 | | mohm |
| R _{DS(ON)3} | Drain to source resistance | V _d =30V, V _s =0V | | 130 | | mohm |
| R _{DS(ON)4} | Drain to source resistance | V _d =30V, V _s =0V | | 131 | | mohm |

Note 6: Stress beyond the maximum ratings listed above may incur permanent damage to the device. Operating above the recommended conditions for extended time may stress the device and affect device reliability. Also the device may not operate normally above the recommended operating conditions. These are stress ratings only.

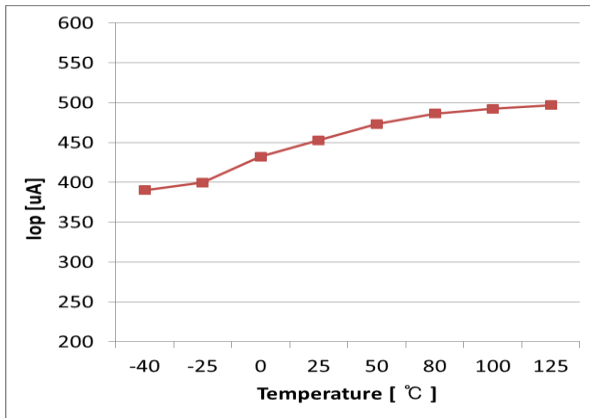
Typical Operating Characteristics



V_{OVP_L} Vs. temperature



V_{OVP_H} Vs. temperature

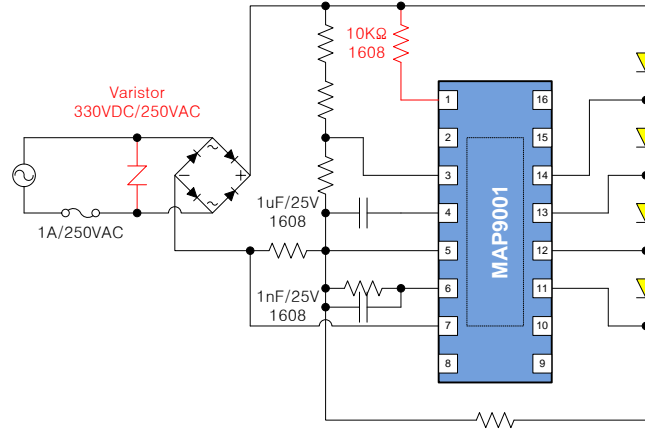


Operating current Vs. temperature

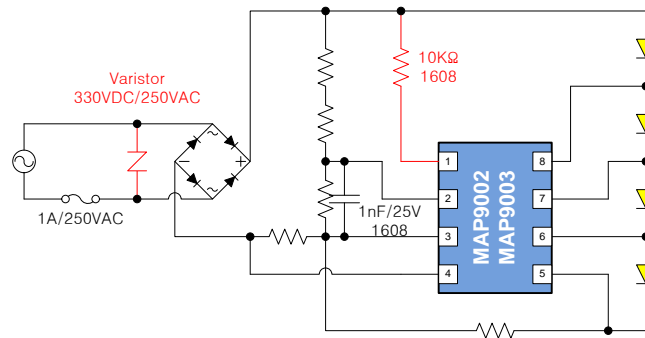
Recommended Surge Protection Circuit

The surge test using our demo-board and pass 0.5KV surge voltage at input wattage 16W

- MAP9001

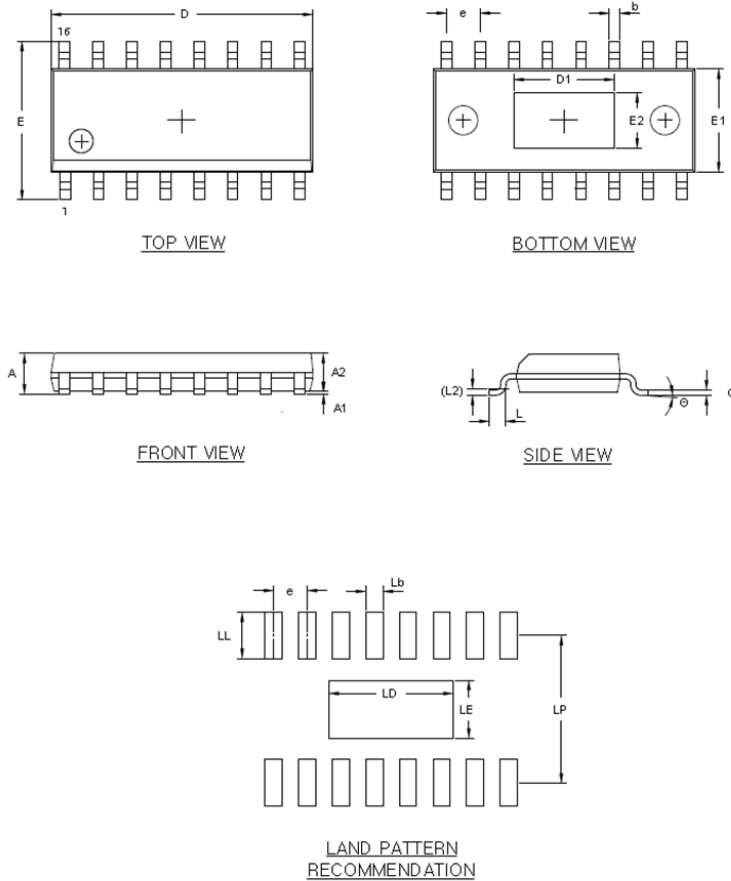


- MAP9002 & MAP9003



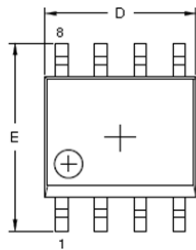
Physical Dimensions

1) ESOP 16LD

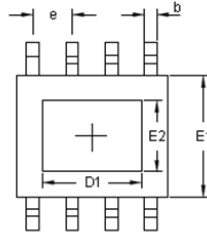


| Symbol | Dimension [mm] | |
|--------|--------------------|------|
| | min | max |
| A | - | 1.70 |
| A1 | 0.00 | 0.15 |
| A2 | 1.25 | - |
| b | 0.31 | 0.51 |
| c | 0.10 | 0.25 |
| D | 9.90 BSC | |
| D1 | 3.60 | 4.00 |
| E | 6.00 BSC | |
| E1 | 3.90 BSC | |
| E2 | 1.90 | 2.30 |
| e | 1.27 BSC | |
| θ | 0° | 8° |
| L | 0.40 | 1.27 |
| L2 | 0.25 (GAUGE PLANE) | |
| Lb | 0.60 | |
| LD | 4.70 | |
| LE | 2.20 | |
| LL | 1.75 | |
| LP | 5.60 | |

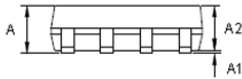
2) ESOP 8LD



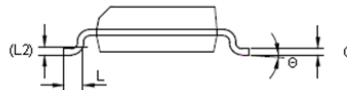
TOP VIEW



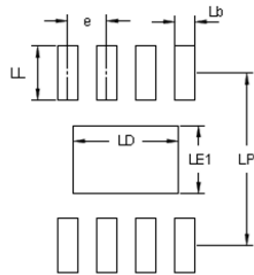
BOTTOM VIEW



FRONT VIEW



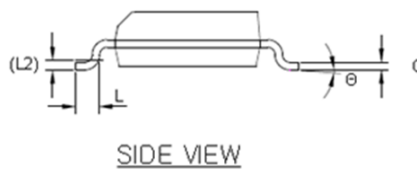
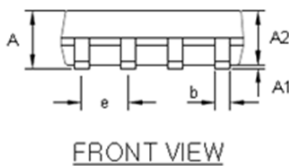
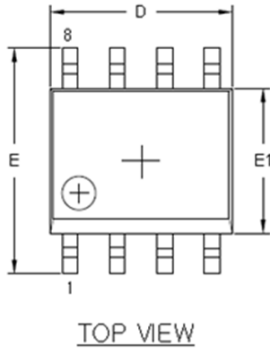
SIDE VIEW



LAND PATTERN RECOMMENDATION

| Symbol | Dimension [mm] | |
|--------|-------------------|------|
| | min | max |
| A | - | 1.70 |
| A1 | 0.00 | 0.15 |
| A2 | 1.25 | - |
| b | 0.31 | 0.51 |
| c | 0.10 | 0.25 |
| D | 4.90 BSC | |
| D1 | 2.95 | 3.35 |
| E | 6.00 BSC | |
| E1 | 3.90 BSC | |
| E2 | 2.05 | 2.45 |
| e | 1.27 BSC | |
| θ | 0° | 8° |
| L | 0.40 | 1.27 |
| L2 | 0.25(GAUGE PLANE) | |
| Lb | 0.60 | |
| LD | 3.40 | |
| LE | 2.20 | |
| LL | 1.75 | |
| LP | 5.60 | |

3) SOP 8LD



| Symbol | Dimension [mm] | |
|----------|--------------------|------|
| | min | max |
| A | - | 1.75 |
| A1 | 0.10 | 0.25 |
| A2 | 1.25 | - |
| b | 0.31 | 0.51 |
| c | 0.10 | 0.25 |
| D | 4.90 BSC | |
| E | 6.00 BSC | |
| E1 | 3.90 BSC | |
| e | 1.27 BSC | |
| θ | 0° | 8° |
| L | 0.40 | 1.27 |
| L2 | 0.25 (GAUGE PLANE) | |

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